



A Profile of Pedestrian Fatalities in King County, Washington 2000-2003



HEALTHY PEOPLE. HEALTHY COMMUNITIES.



City of Seattle



King County

A Profile of Pedestrian Fatalities in King County 2000-2003

June 2005



HEALTHY PEOPLE. HEALTHY COMMUNITIES.



City of Seattle



King County

Violence and Injury Prevention

999 Third Avenue, Suite 500

Seattle, WA 98104

206-296-4205 TTY: 711

<http://www.metrokc.gov/health/injviol.htm>

Acknowledgements

Author:

Eunyoung Lim

Editor:

Deanne Boisvert

GIS Maps:

Peter Isaksen

Graphic Design:

Sue McCauley

Advisors for the Project

Tony Gomez, Program Manager
Violence and Injury Prevention
Public Health-Seattle & King County

Deanne Boisvert
Violence and Injury Prevention
Public Health- Seattle & King County

Diana Miglioretti, PhD
Group Health Cooperative Center for Health
Studies

Acknowledgements

Feet First

David Levinger, PhD

King County Medical Examiner's Office

Greg Hewett
Richard Harruff, MD

King County Prosecuting Attorney's Office

Amy Freedheim, JD

Police Departments

Auburn Police Department
Bellevue Police Department
Federal Way Police Department
Kent Police Department
King County Sheriff's Office
Kirkland Police Department
Mercer Island Police Department
Renton Police Department
Seattle Police Department
Tukwila Police Department
Washington State Patrol

Public Health- Seattle & King County

James Apa
Matias Valenzuela, PhD
Lisa Werlech

University of Washington

Fred Connell, MD, MPH
School of Public Health and Community
Medicine- Community Oriented Public Health
Program (COPHP)

COPHP Colleagues and Friends

Washington State Traffic Safety Commission

Gina Beretta, PhD
Lynn Drake

Special Acknowledgements

The author would like to recognize the following individuals for their special contributions to this project:

Deanne Boisvert
Public Health-Seattle & King County

Tony Gomez
Public Health-Seattle & King County

Diana Miglioretti
Group Health Cooperative Center for Health
Studies

Genevieve Rowe
Public Health-Seattle & King County

Sergeant Don Smith
Seattle Police Department

*Support from the Washington Traffic Safety
Commission made this report possible.*

Alternative Formats Available

206-296-4205 TTY Relay: 711

Table of Contents

Acknowledgements	ii
A Profile of Pedestrian Fatalities in King County, Washington — 2000-2003	1
Executive Summary	1
Introduction	3
Methods	4
Key Findings	5
Demographic Characteristics of Fatally Injured Pedestrians	6
Age and Gender	6
<i>Chart:</i> Pedestrian Fatalities by Age — King County 2000-2003	6
<i>Chart:</i> Pedestrian Fatalities by Gender — King County 2000-2003	6
<i>Table:</i> Average Pedestrian Fatality Rates per 100,000 Populations — King County 2000-2003	7
<i>Chart:</i> Age-Specific Pedestrian Fatality Rates — King County 2000-2003	7
Race and Ethnicity	7
<i>Chart:</i> Pedestrian Fatalities by Race/Ethnicity — King County 2000-2003	7
Vulnerable Populations	7
Discussion	7
High Risk Populations	7
Adults ages 40-49 years old	7
<i>Pedestrian Case Narrative:</i> Forty-five year old male	8
Older Adults — 60 year and greater	9
<i>Pedestrian Case Narrative:</i> Seventy-five-year-old female	9
Special Consideration	9
Children	9
<i>Pedestrian Case Narrative:</i> Male child	9
Alcohol Involvement	10
<i>Table:</i> Pedestrian Alcohol Involvement and Time at Event — King County 2000-2003	10
<i>Chart:</i> Alcohol-Related Pedestrian Fatalities by Age Group — King County 2000-2003	10
Time and Environmental Characteristics	11
Months	11
<i>Chart:</i> Pedestrian Fatalities by Month — King County 2000-2003	11
Days of the Week	11
<i>Chart:</i> Pedestrian Fatalities by Days of the Week — King County 2000-2003	11
Hours of the Day	11
<i>Chart:</i> Pedestrian Fatalities by Hours of Day — King County 2000-2003	11
Environmental Factors	12
<i>Chart:</i> Pedestrian Fatalities by Light Condition — King County 2000-2003	12
Discussion	12

Location Characteristics	13
<i>Chart:</i> Pedestrian Fatalities by Cities — King County 2000-2003	13
Type of Roadway	13
<i>Chart:</i> Pedestrian Fatalities by Road Types in King County — King County 2000-2003	13
Pedestrian Activities Prior Impact	14
<i>Chart:</i> Pedestrian Fatalities by Pedestrian Activity — King County 2000-2003	14
<i>Table:</i> Total Pedestrian Contributing Factors — King County 2000-2003	14
<i>Table:</i> Pedestrian Fatalities by Pedestrian's Primary Activity — King County 2000-2003	15
Driver Characteristics and Contributing Factors	16
Age and Gender	16
<i>Chart:</i> Pedestrian Fatalities by Driver's Age — King County 2000-2003	16
Speed at Impact	16
<i>Table:</i> Posted Speed on the Roadways for Pedestrian Fatalities — King County 2000-2003	16
Vehicle Type	17
<i>Chart:</i> Pedestrian Fatalities by Vehicle Type — King County 2000-2003	17
Vehicle Activity at Impact	17
<i>Chart:</i> Vehicle Activity at the Time of Incident — King County 2000-2003	17
Driver Medical Conditions	17
Alcohol Involvement	17
<i>Table:</i> Alcohol Use by Drivers Involved in Pedestrian Fatality Crashes by Sex and Age Group — King County 2000-2003	17
Hit and Run	17
Driver-Related Contributing Factors and Traffic Citations	18
<i>Chart:</i> Total Driver Contributing Factors — King County 2000-2003	18
<i>Chart:</i> Traffic Citations — King County 2000-2003	18
Recommendations	19
References	21
Maps	23
Pedestrian Fatalities by Gender and Age in King County 2000-2003	23
Pedestrian Fatalities by Race/Ethnicity in King County 2000-2003	24
Pedestrian Fatalities by Alcohol Involvement in King County 2000-2003	25
Pedestrian Fatalities in Downtown Seattle Area 2000-2003	26
Pedestrian Fatalities in City of Kent in King County 2000-2003	27
Pedestrian Fatalities in City of Renton in King County 2000-2003	28
Pedestrian fatalities in City of Federal Way in King County 2000-2003	29
Pedestrian Fatalities in City of Shoreline in King County 2000-2003	30
Pedestrian Fatalities in City of Tukwila in King County 2000-2003	31
Pedestrian Fatalities in City of Auburn in King County 2000-2003	32

A Profile of Pedestrian Fatalities in King County, Washington — 2000-2003

Executive Summary

Researcher

Eunyoung Lim, MPH

Aim

1. To collect and analyze pedestrian fatality data for person, time, and place characteristics and other factors contributing to pedestrian fatalities in King County, Washington.
2. To map “pedestrian fatality locations” using geographical information systems (GIS).
3. To research and recommend evidence-based pedestrian safety interventions.

Methods

Reviewed medical examiner records, police reports, and newspaper articles, from January 1, 2000 to December 31, 2003, for all pedestrian-motor vehicle crashes that occurred in King County, WA and resulted in a pedestrian fatality. A 103 cases were included in this study.

Constructed a database, using the statistical program STATA v. 8.0, to manage and analyze information gleaned from the data sets. Used GIS to map the “pedestrian fatality locations.”

Conducted key informant interviews and a literature review to gain an understanding of findings and determine intervention recommendations.

Key Findings

- On average, 26 pedestrians are fatally injured in King County every year.
- Pedestrians make up nearly 20 percent of motor vehicle crash fatalities (USA 11 percent, WA 12 percent).
- Males accounted for the majority (62 percent) of pedestrian fatalities. Males 40 - 49 years old accounted for about 22 percent of all the deaths.
- Young children, 0-9 years old, were least likely to be fatally injured.
- One in four deaths (25 percent) were to persons 60 years and older. After age 60, females accounted for the majority of pedestrian fatalities.
- Women ages 70 - 79 years old have the highest pedestrian fatality rate (4.27/100,000) in King County.
- 40-49 year olds made up the greatest proportion of all fatalities- almost 30 percent.
- People of color made up nearly 40 percent of the pedestrian deaths. In particular, Asian and Pacific Islanders and American Indians/Alaska Natives were disproportionately affected in pedestrian crash fatalities.
- November, December, and January are especially dangerous months for pedestrians.
- Pedestrian fatalities occurred at all hours of the day but were most likely to happen during times of darkness and work rush hours.

- Nearly half the deaths occurred in Seattle.
- Ten percent (N=10) happened on State Route 99/Aurora Avenue.
- Most pedestrian-motor vehicle crashes occurred while individuals were crossing roadways.
- Forty-two percent of fatalities were the result of unsafe crossing practices.
- Alcohol was a factor in approximately 30 percent of these deaths.
- Nearly 60 percent of the fatalities that occurred on state routes involved a pedestrian or driver, or both, who had been drinking.
- More than half (59 percent) of the pedestrians were killed on roads with posted speed limits of 35 mph or less.
- When noted, police reports indicated that they found no fault with the driver's actions in 45 percent of the cases.

Implications for Practice or Policy

This study's findings suggest that a commitment from key leaders, backed by funding, is needed to reduce pedestrian fatalities. Funding should support education, engineering, enforcement, and continued surveillance efforts. Education of high risk populations and drivers is of particular importance. Engineering strategies could include traffic calming measures and increased street lighting. Enforcement should target both pedestrians and drivers and red light running. A system to track both pedestrian fatalities and injuries is crucial to inform the activities of traffic safety advocates from the public, private, and non-profit sectors.

What next?

1. Convene a King County pedestrian traffic safety conference.
2. Create a King County pedestrian safety advisory group to provide a forum to address issues.
3. Extend this study to include non-fatal pedestrian injuries within King County.
4. Conduct a knowledge, attitude, and behavior survey (KABS) of King County residents to learn about the public's perceptions and behaviors related to pedestrian safety.
5. Design and implement educational efforts with the identified intervention groups.
6. Increase pedestrian safety enforcement activities.
7. Design and implement a pedestrian visibility campaign that targets both drivers and pedestrians.
8. Work with city, county, and state departments of transportation to ensure that high-risk locations are properly illuminated with street lights and that broken lamps are promptly repaired.
9. Educate pedestrians about the risks of alcohol and walking.
10. Advise and educate drivers on the safest ways to deal with mechanical failure in the roadway, especially on the freeway and highways.

For further details, contact:

Tony Gomez, Program Manager
Violence and Injury Prevention
Public Health-Seattle & King County
999 Third Avenue, Suite 500
Seattle, WA 98104-4041

Tony.gomez@metrokc.gov
206-296-4205

Introduction

Walking upright on two limbs is a distinctly human behavior that serves as our most basic form of transportation. Furthermore, walking is a simple way to be active, relax, and enjoy time with loved ones. However, as road traffic has increased so have the hazards confronting pedestrians. Identifying and alleviating these hazards reduces pedestrian injuries and fatalities and encourages more people to walk, ultimately improving the health and well-being of the communities in King County, Washington.

Magnitude of the Problem

Everyday hundreds of pedestrians are killed or injured by traffic collisions. On average, in the United States, a pedestrian is injured in a traffic crash every 8 minutes and killed every 111 minutes. Nationally, pedestrian fatalities make up 11 percent of all motor vehicle crash deaths, which totaled 4,749 deaths in 2003. In addition, 70,000 pedestrians were injured that year.¹

Between 1993 and 2002, an average of 84 pedestrian fatalities and 449 pedestrian injuries occurred in Washington State each year. Pedestrian deaths accounted for 12 percent of all motor vehicle crash fatalities in Washington during the 10-year period.²

As pedestrian fatalities and injuries are most common in urban areas, Seattle and King County have by far the greatest number of pedestrian fatalities and injuries in Washington.

In King County, from 1993-2002, a total of 272 pedestrian fatalities occurred and 1891 pedestrians were hospitalized due to severe injuries. Pedestrians accounted for 19% of all motor vehicle crash fatalities and 17 percent of motor vehicle crash injuries. Thus, pedestrians in King County constituted a greater percentage of total motor vehicle crash deaths than they did statewide (12 percent) or nationally (11 percent). In King County, one out of every five motor vehicle crash fatalities is a pedestrian, compared to one in ten nationally.^{1, 2}

Pedestrian injuries and fatalities are not “accidents.” These fatal incidents are both unnecessary and preventable. This study examined King County Medical Examiner records for 103 pedestrians who died in pedestrian-motor vehicle crashes in King County, Washington between January 2000 and December 2003. The records were reviewed for person, time, and place characteristics for both the pedestrian and driver in each incident. The study also sought to identify other factors that may have contributed to the death of the pedestrian. This data was collected and analyzed to identify possible risk factors associated with pedestrian fatalities in King County, Washington.

Methods

This study examined all pedestrian-motor vehicle crash fatalities that occurred in King County, Washington, from January 1, 2000 to December 31, 2003.

These cases were identified by the King County Medical Examiner's Office (KCMEO). The KCMEO investigates all "sudden, violent, unexpected, and suspicious deaths" within the county, including deaths due to traffic crashes.

The KCMEO provided medical examiner reports and death certificate data which contained demographic information on the deceased pedestrians such as their age, race, and occupation. This data set also included the time, location, and a summary of each incident. In addition, each medical examiner report was matched with a police report of the case.

Thus, the researcher obtained most of the police records for each pedestrian fatality. These police reports contained charts, police narratives, and witness statements which provided useful and relevant data elements that allowed the researcher to better understand and describe the burden of injury from pedestrian-motor vehicle crashes. For example, these records provided in-depth information about the incident and the location including roadway conditions, weather conditions, and location characteristics. They also detailed pedestrian and driver activities at the time of crash.

The researcher also collected and reviewed newspaper articles from various Seattle and King County newspapers.

From the three sources- medical examiner reports, police records, and newspaper articles- the researcher constructed a database, using STATA v. 8.0, to collate and analyze the circumstances of the pedestrian-motor vehicle crashes. To better understand the characteristics associated with pedestrian fatalities in King County, the researcher used STATA to calculate rates and perform cross tabulations on the data.

In addition, pedestrian-motor vehicle crash locations were mapped using Geographical Information Systems (GIS). Through this technique, "pedestrian fatality locations" were identified.

Lastly, the researcher conducted key informant interviews and a literature review to gain an understanding of the findings and determine intervention recommendations.

Key Findings

The following are the key findings from the analyzed King County data:

- On average, 26 pedestrians are fatally injured in King County every year.
- Pedestrians make up nearly 20 percent of motor vehicle crash fatalities.
- Males accounted for the majority (62 percent) of pedestrian fatalities. Males 40 - 49 years old accounted for about 22 percent of all the deaths.
- Young children, 0-9 years old, were least likely to be fatally injured.
- One in four deaths were to persons 60 years and older. After age 60, females accounted for the majority of pedestrian fatalities.
- Women ages 70 - 79 years old had the highest pedestrian fatality rate (4.27/100,000).
- 40-49 year olds made up the greatest proportion of all fatalities- almost 30 percent.
- People of color made up nearly 40 percent of the pedestrian deaths. In particular, Asian and Pacific Islanders and American Indians/Alaska Natives were disproportionately affected in pedestrian crash fatalities.
- November, December, and January are especially dangerous months for pedestrians.
- Pedestrian fatalities occurred at all hours of the day but were most likely to happen during times of darkness and work rush hours.
- Nearly half the deaths occurred in Seattle.
- Ten percent (N=10) happened on State Route 99/Aurora Avenue.
- Most (62 percent) pedestrian-motor vehicle crashes occurred while individuals were crossing roadways.
- Forty-two percent of fatalities were the result of unsafe crossing practices.
- Alcohol was a factor in approximately 30 percent of these deaths.
- Nearly 60 percent of the fatalities that occurred on state routes involved a pedestrian or driver, or both, who had been drinking.
- When noted, forty-five percent of the police reports indicated that they found no fault with the driver's actions.
- More than half (59 percent) of the pedestrians were killed on roads with posted speed limits of 35 mph or less.

Demographic Characteristics of Fatally Injured Pedestrians

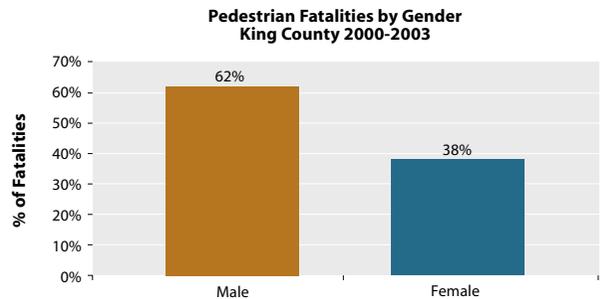
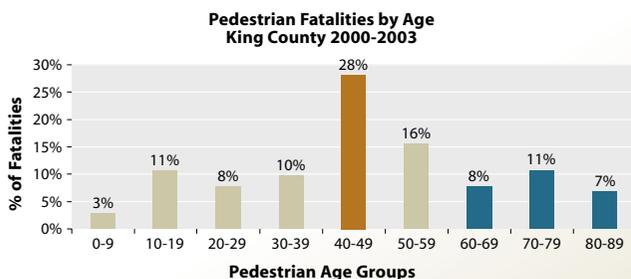
Over the years studied, an average of 26 pedestrian deaths occurred per year in King County. They ranged from a minimum of 20 deaths in 2000 to a maximum of 33 deaths in 2001. The average overall fatality rate per 100,000 population was 1.46. This is slightly lower than the United States (2003) rate of 1.63, but higher than the Washington state rate of 1.22 (2003).

Nationally, males, older pedestrians, and communities of color are disproportionately represented in pedestrian fatalities. This trend is also reflected in King County.

This section characterizes demographic factors of fatally injured pedestrians in King County.

Age and Gender

- The age of pedestrians ranged from 2 years to 86 years, with an average age of 47 years (standard deviation = 20.3).
- Young children (age 0-9 years) had the least number of deaths (N=3).
- Forty to forty-nine year olds were involved in nearly 3 out of 10 pedestrian fatalities.
- Older pedestrians, 60 years old and greater, constituted 25 percent (N=26) of the fatalities.
- Males accounted for the majority (62 percent) of pedestrian deaths in King County. They were 1.6 times more likely to be a victim of a pedestrian-motor vehicle crash as females.

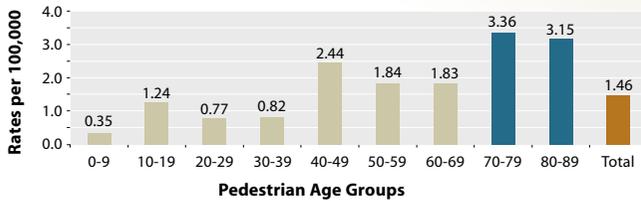


- Up to age 59, males made up a greater proportion of the pedestrian fatalities. However, from age 60 and older, there was a shift, making females more vulnerable. Among older pedestrians, females were almost twice as likely to be killed as older males.
- The overall fatality rate per 100,000 was higher for males (1.82) than for females (1.10).
- Young children, 0-9 year olds had the lowest fatality rate, while 70-79 year olds had the highest rate among all age groups. Females 70 - 79 years old had the highest fatality rate.

**Average Pedestrian Fatality Rates per 100,000 Populations
King County 2000-2003**

Age Group	Females	Males	Total
0-9	0.24	0.45	0.35
10-19	0.69	1.77	1.24
20-29	0.59	0.94	0.77
30-39	0.17	1.44	0.82
40-49	1.18	3.68	2.44
50-59	1.59	2.08	1.84
60-69	2.23	1.41	1.83
70-79	4.27	2.14	3.36
80-89	2.74	3.92	3.15
Total	1.10	1.82	1.46

Age-Specific Pedestrian Fatality Rates
King County 2000-2003



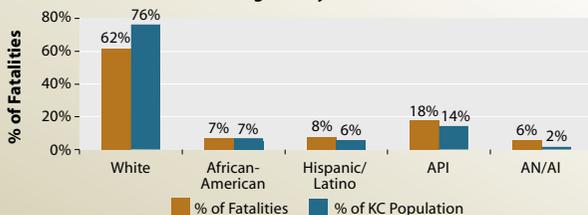
- There were three major spikes in the fatality rate: 10-19 year olds, 40-49 year olds, and 70-89 year olds.

Race and Ethnicity

Communities of color were disproportionately represented in the pedestrian fatalities studied. For example, 76 percent of the King County population is white, nearly 14 percent are Asian/Pacific Islanders (API), seven percent are African-American, nearly six percent Hispanic/Latino, and nearly two percent Alaskan Natives/American Indian (AN/AI). However, whites represented only 62 percent of the total fatalities. Communities of color represented over 38 percent of all pedestrian fatalities.

- Asian/Pacific Islanders accounted for 18 percent of all pedestrian fatalities but 14 percent of the population.
- Alaskan Natives/American Indians accounted for six percent of these fatalities but only two (approximately) percent of the population.
- Latinos were also over-represented.
- In the City of Seattle, Asian/Pacific Islanders made up 26 percent (12 out of 46) of pedestrian traffic fatalities, while they comprise 14 percent of Seattle’s population.

Pedestrian Fatalities by Race/Ethnicity
in King County 2000-2003



Vulnerable Populations

Of the 103 pedestrian fatalities investigated, 10 were identified as having medical/physical health conditions that may have contributed to the pedestrian-motor vehicle collision.

The health conditions observed included:

- Alzheimer’s disease
- Mental disabilities
- Blindness
- Cerebral Palsy
- Persons utilizing mobility aides, such as canes and wheel chairs
- Heart disease
- Disorientation

Discussion

High Risk Populations

After examining the data set, two groups stand out as populations at high risk of being killed by a motor vehicle while walking on or crossing roadways. These are adults ages 40 - 49 years old and older pedestrians, ages 70 and greater.

Adults ages 40-49 years old

In King County, 40-49 year olds had the greatest number of deaths and had one of the highest fatality rates. It is not clear why adults in this group are being struck by motor vehicles.

Further analyses of this group found that 38 percent of these fatalities were people of color, especially African-Americans and Hispanics. In fact, five out of the seven African American pedestrian deaths were in this age group.

In addition, males in this group were highly susceptible to being victims of pedestrian-motor vehicle crashes. One in five pedestrian deaths in King County was of a male in this age group.

Nine out of 29 (31 percent) of the people in this age group had no stable form of employment. They were classified by the

Medical Examiner's Office as a laborer, unemployed, disabled, or homeless.

This age group also had the highest level of alcohol involvement. Of the 23 fatalities that involved alcohol, nearly 40 percent (N=9) were people in this age group. About a third of the people in this age group were under the influence of alcohol.

In several of the incidents, pedestrians were attempting to cross freeways and highways in the dark. Other cases involved pedestrians engaging in dangerous activities, such as crossing the roadway at mid-block, against the light at a crosswalk, crossing without looking for oncoming traffic, stepping off the sidewalk, or running away from the police or a family member. In several of these cases, the victim was engaged in these activities while they were also impaired by alcohol.

However, a number of times the pedestrian was not at fault. These cases included drivers who were under the influence of drugs or alcohol, involved in multi-vehicle crashes, speeding, and/or failing to yield the right of way to the pedestrian at crosswalks. In some cases, the driver's medical condition caused them to lose control of the car and hit the pedestrian.

After a thoroughly examining the 29 fatalities in this age group, there appear to be no clear trends or risk factors- except that pedestrians in this age group were killed disproportionately. However, some factors associated with fatalities in this age group were: walking under the influence, not practicing safe crossing behaviors, and lack of permanent employment.

■ **Older Adults — 60 years and greater**

It is well documented that older adults have the highest rates of pedestrian fatalities. Twenty percent of people age 65 years old and older do not drive at all and more than half make walking a routine part of their lives.⁵ This exposure to cars, plus declining motor and cognitive skills, put older adults at higher risk of being killed on the road.

In depth analysis of the King County data revealed that there were more female pedestrian deaths in this age group than male deaths- a different trend than observed in other age groups.

Whites made up 64 percent of these fatalities. The rest of these fatal events were to older Asian & Pacific Islanders. No one Asian nationality was overrepresented. The deaths were evenly distributed among several nationalities: Japanese, Chinese, Korean, Filipino, Laotian, and Vietnamese.

Only one death involved alcohol in this older age group. This suggests that, in this age group, alcohol is not a major contributing factor to pedestrian fatalities.

Of further note, 73 percent (N=19) of elderly fatalities occurred during the hours of 6 a.m. to 9 p.m.

Most crashes involving older pedestrians occurred on a city street (77 percent). In two-thirds of the cases, the pedestrian attempted to cross a street at either a marked or an unmarked crosswalk.

Forty-five year old male

On a dark, late afternoon in the winter, a forty-five year old man attempted to cross a city street at an unmarked intersection, without traffic signals. Intoxicated with alcohol and dressed in a black sweater and pants, he stepped off the sidewalk and staggered across the roadway. Slowly he made his way to the other side, unaware of a northbound car that almost hit him. Just as he stumbled into the southbound lane, an approaching driver spotted him and swerved to avoid hitting him. Unfortunately, the driver was powerless to stop in time. The vehicle's front, right side hit the man and he died on impact.

Seventy-five-year-old female

On a sunny afternoon in Seattle, a woman attempted to cross the street at an intersection with a marked crosswalk. However, the crosswalk had no traffic control except for an overhead, yellow “crosswalk” sign. Car (1) saw the woman step into the crosswalk and came to a sudden stop. The driver in Car (2) failed to scan the intersection and did not see the woman; he tried to break through because of Car (1)’s sudden stop. Tragically, Car (2) could not stop quickly enough and hit the woman. Feeling safe because she was in a crosswalk, the woman had never checked for oncoming vehicles when she stepped into the street.

Though older pedestrians may be more likely to use crosswalks, they remain vulnerable to being struck by vehicles while crossing roadways. A study conducted by Koepsell and et al. found that:

“Crosswalk markings appear associated with increased risk of pedestrian-motor vehicle collision to older pedestrians at sites where no signal or stop sign is present to halt traffic. Almost all of the excess risk was due to 3.6-fold (95 percent confidence interval, 1.7-7.9) higher risk associated with marked crosswalks at sites with no traffic signal or stop sign.”⁶

This study suggests that it is crucial to identify areas with high volumes of older pedestrians and place not only marked crosswalks but also crosswalks with traffic controls, so that vehicles must stop for pedestrians as they cross the road.

Special Consideration

■ Children

In this study, children ages 0-9 had the fewest number of pedestrian fatalities. However, that number may be misleading because a number of children who are struck and killed by motor vehicles are hit in driveways or on private roads. These deaths are categorized as a “general

accident,” not a “traffic fatality” by the KCMEO. Thus, the number of children struck by motor vehicles may be higher.

Furthermore, national data shows that although five to nine year olds have one of the lowest pedestrian fatality rates, they have the highest injury rate of all age groups.¹

In addition, children, age five to nine, are vulnerable road users because they have not yet developed the knowledge or the perceptual skills to make consistent and correct choices to use safely use the roadways. Thus, children are more likely to be struck by a motor vehicle on urban residential streets during a mid-block dart out or when running through intersections without looking.^{7,8}

In this study, there were eight cases involving children under the age of 18. Three fatalities occurred during mid-block crossings. Two incidents occurred when vehicles in one lane stopped but those in the other did not- hitting the children as they attempted to cross. This suggests that children need to be taught to continuously look left and right even when crossing in a crosswalk — marked or unmarked — and even when one or more vehicles have stopped. Drivers must also be educated about this issue.

Male child

Returning from a convenience store, a young boy attempted to cross a five-lane road at dusk. The nearest crosswalk was 300 feet away, so the young boy tried to run across the road at mid-block during rush hour traffic. A truck, in the inside lane, made a sudden stop for the running child. After stopping briefly in front of the truck, the child continued running into the outside lane. A car traveling in this lane noticed that the truck stopped but did not see why and kept moving. By the time the driver of the car saw the boy it was too late to avoid colliding with him. The young boy died at the scene.

Alcohol Involvement

Alcohol is an important factor in pedestrian-motor vehicle crashes. The National Highway Transportation and Safety Administration (NHTSA) considers a fatal crash to be “alcohol-related” if the driver or a non-occupant (e.g. pedestrian) has a blood alcohol concentration (BAC) greater than or equal to 0.01 g/dl in a police-reported traffic crash.⁹

Nationally, 37 percent of fatal pedestrian injuries were alcohol-related (2001). Males were more likely to be fatally injured than females (44 percent vs. 22 percent). The majority of individuals involved in alcohol-related fatal crashes had high BAC level (greater than or equal to 0.08 g/dl).⁹

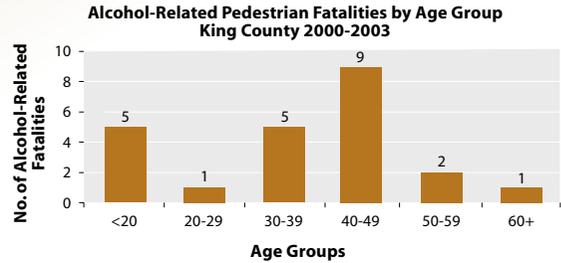
In Washington State (from 1993 to 2003), among fatally injured pedestrians whose BAC level was known, 38 percent tested positive for alcohol.¹⁰

In 2003, the KCMEO reported that of the pedestrian fatalities that were tested for alcohol, 21 percent tested positive.¹¹

NOTE: Due to limitations in obtaining alcohol-related information, the information presented here should be interpreted with caution.

**Pedestrian Alcohol Involvement and Time of Event
King County 2000-2003**

Time	Alcohol+	Alcohol+ Row%	Total Fatalities
12:00-2:59 AM	3	30%	10
3:00-5:59 AM	6	86%	7
6:00-8:59 AM	0	0%	16
9:00-11:59 AM	0	0%	6
12:00-2:59 PM	1	7%	14
3:00-5:59 PM	1	9%	11
6:00-8:59 PM	3	15%	20
9:00-11:59 PM	9	47%	19
Total	23	22%	103



- In this study, 23 (22 percent) incidents noted alcohol involvement.
- Males showed a greater extent of alcohol involvement than females. Twenty males and three females were identified as alcohol positive.
- Pedestrians 40-49 years old had the highest number of alcohol positive fatalities (N=9).
- Five 18-19 year olds tested positive for alcohol or other drugs.
- Among 30-39 year olds, five out of ten (50 percent) fatalities involved alcohol. Thus, this age group had the highest percentage of alcohol involvement among all age groups.
- Most of the alcohol-related pedestrian fatalities occurred between the hours of 9 p.m. and midnight (N=9), followed by 3 to 6 a.m. (N=6).
- Six out of the seven pedestrian fatalities that occurred between 3 and 6 a.m. were alcohol-related.
- Tuesday had the most alcohol-related pedestrian fatalities with a total of five. Monday was next with four incidents.
- Five of the alcohol positive fatalities occurred on State Route 99/Aurora Avenue. Half of the fatalities on State Route 99/Aurora Avenue were alcohol-related.
- Nearly half (N=11) of alcohol-related fatalities took place on state routes (including State Route 99/Aurora Avenue).

Time and Environmental Characteristics

Months

The winter months, because of shorter daylight hours, are the most dangerous times for pedestrians in King County.

- Forty-five percent of all pedestrian deaths occurred during the months of November through February.
- December had the highest number of pedestrian fatalities with 14 deaths. June had the least with five deaths.
- Compared to June (which has the longest daylight hours), the risk of a pedestrian fatality in December (which has the shortest daylight hours) is 2.8 times higher.

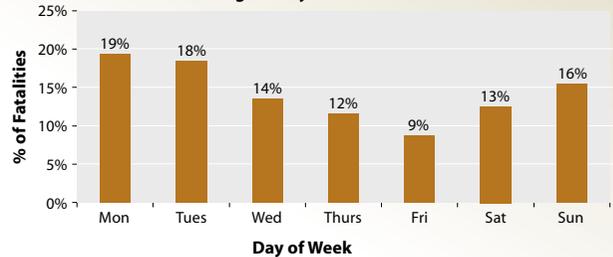


Days of the Week

Most of the pedestrian deaths in King County occurred during the week. This differed from the national data, which found that almost half (48 percent) of pedestrian deaths occurred on weekends.

- Monday and Tuesday had the most pedestrian incidents. Those two days accounted for nearly 40 percent of all pedestrian deaths.
- Sunday was the most dangerous weekend day.

**Pedestrian Fatalities by Days of the Week
King County 2000-2003**

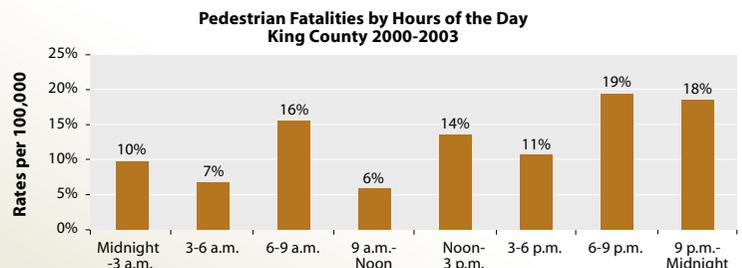


- Friday had the fewest number of pedestrian fatalities.

Hours of the Day

Pedestrian-motor vehicle crashes occur at all hours of the day. However, pedestrians were more likely to be hit when it was dark or during the work rush hours.

- More pedestrians were hit at 6 a.m. than any other hour. Thirteen percent (N=13) of fatalities occurred during that hour alone.
- Forty percent of fatalities took place between 6 - 9 p.m. (19 percent) and 9 p.m. - midnight (18 percent).
- There was a relationship between gender and time of incident. During the day, males and females had a similar risk of being killed (47 percent versus 53 percent), but during nighttime conditions, males were more than twice as likely to be struck by a vehicle (69 percent versus 31 percent).



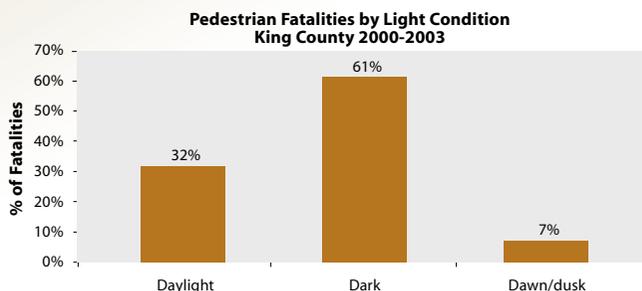
Environmental Factors

Poor visibility during adverse weather and nighttime hours make it difficult to see pedestrians using the roadways. Hence, these conditions were the most hazardous for pedestrians. The combination of dark hours, rainy conditions, and dark clothes all decreases the driver's ability to detect pedestrians.

- About one third of deaths occurred during rainy conditions. Police reports showed that 34 percent of deaths took place under wet road conditions and 30 percent of fatalities occurred while it was raining.
- Only 22 percent of Washington's pedestrian-motor vehicle collisions occurred during adverse weather, compared to 30 percent in King County.¹⁰
- Most pedestrian motor vehicle collisions happened when it was dark. More than two-thirds (69 percent) of incidents took place during the night or at dawn/dusk.
- Nearly 40 percent of the fatalities that occurred during dark conditions also coincided with rainy weather. In daylight conditions, only 13 percent of fatalities coincided with rain.
- Three deaths occurred in areas that had broken or burnt out streetlights.
- Seventy percent of pedestrians in this study were reported as wearing either dark or mixed clothing at the time of the fatal incident.

Discussion

At night it is difficult for drivers to see pedestrians because of a combination of insufficient lighting, dark clothing worn by pedestrians, low-beam headlights, and lack of visual searching by drivers. This combination may be responsible for the approximately 25 percent of the drivers who reported being



unaware of the pedestrian until the moment of impact.¹² In addition, many pedestrians overestimate their visibility when they cross streets at night.

Studies have shown that reflective clothing can dramatically increase driver ability to detect pedestrians in poor light conditions. However, many pedestrians remain unaware of how difficult it is to see them at night and of the increased visibility properties of reflective clothing.

In a study conducted by Tyrell and et al., participants underestimated their ability to be seen when wearing reflectors, and overestimated their ability to be seen in dark clothing in reduced lighting conditions. Therefore, pedestrians should be advised of the importance of reflective material in increasing their visibility.

Reflective materials have been found to be more effective when pedestrians are crossing a street than when approaching oncoming vehicles. The same study found that reflective material worn on the wrists and ankles was more visible than when worn on the torso. This is of particular importance considering most pedestrian-motor vehicle crashes occur while pedestrians are attempting to cross roadways. The utilization of any reflective materials increases the likelihood of pedestrian detection by drivers. In addition, "fluorescent materials in yellow, red, and orange colours improve detection and recognition in the daytime."¹⁵

Location Characteristics

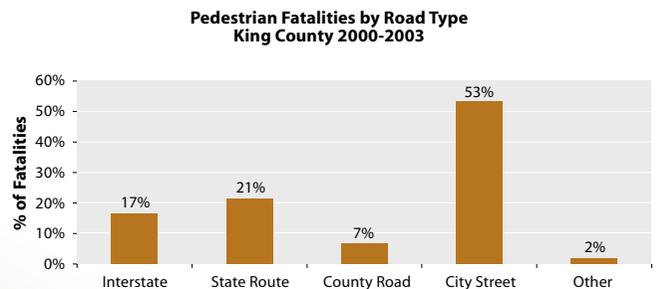
Pedestrian fatalities occur most often in urban settings, with high traffic volume and wide arterials. Whenever vehicles and pedestrians are in the same area, there is conflict.

- This trend was seen in King County too- Seattle had 45 percent (N=46) of all pedestrian fatalities in King County. This suggests that, on average, at least one pedestrian is struck and killed by a motor vehicle in Seattle every month.
- Kent had second highest number of pedestrian fatalities (N=9), followed by Renton (N=7).



Type of Roadway

- More than half (N=55) of pedestrian-motor vehicle collisions took place on city/residential streets.
- A cluster of crash events were found in downtown Seattle.
- Seventeen percent (N=17) of crashes occurred on interstates. Fourteen incidents occurred on I-5 and three on I-405.
- Twenty-one percent (N=22) of the fatalities took place on state routes. Ten incidents, nearly half, occurred on State Route 99/Aurora Avenue.
- Nearly 60 percent of the fatalities that occurred on all state routes involved a pedestrian or driver, or both, who had been drinking.
- On State Route 99, five out of 10 fatally injured pedestrians were positive for alcohol. In two of the ten cases, both the driver and pedestrian had been drinking and in one, just the driver had used alcohol.



Pedestrian Activities Prior to Impact

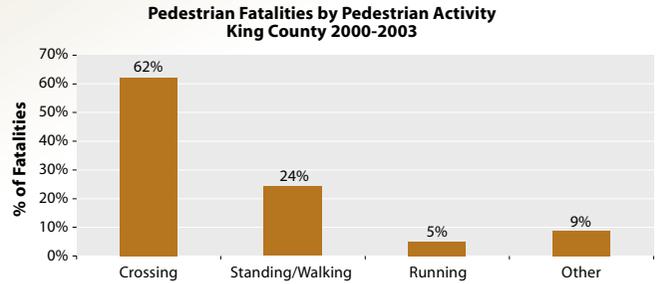
Most pedestrian-motor vehicle crashes happened when pedestrians were attempting to cross a roadway. Many of these incidents involved pedestrians crossing mid-block, against the light, or trying to cross an interstate or state highway.

- In a majority of the cases, police investigators reported that contributing factors by the pedestrian led to the crash.
- Police investigators indicated that the pedestrian was not at fault in 17 of 88 cases (19 percent). This information was missing in 15 cases.
- The most frequently cited contributing factor, excluding “other,” was “failure to use crosswalk” (21 percent).
- “Failure to yield” was next highest (16 percent) and “under the influence of alcohol” was third (10 percent).

**Total Pedestrian Contributing Factors
King County 2000-2003**

Contributing Factors	No.	%
Under the influence of alcohol	11	9.8%
Failure to use crosswalk	23	20.5%
Inattention	9	8.0%
Failure to yield	18	16.1%
Failure to obey	1	0.9%
Apparently ill	1	0.9%
On wrong side of road	1	0.9%
Other	31	27.7%
No errors cited	17	15.2%
Total	112	100.0%
Missing	(15)	

*This total exceeds the number of fatalities because police report may record more than one contributing factor.



Crossing

- The majority (62 percent) of pedestrian fatalities occurred during an attempt to cross a roadway. Nearly one in two deaths took place while crossing in a marked or unmarked crosswalk.
- Police reported that seven pedestrians were walking against the pedestrian signal.
- Of the 64 pedestrians crossing a roadway, 36 percent (N=23) were crossing at a no-crossing zone or mid-block.
- State Route 99/Aurora Avenue/Pacific Highway South had six fatalities of pedestrians attempting to cross mid-block or at no-crossing zones.
- More than one-third (N=23) of attempted crossings occurred on high-speed arterials, interstates, and state roads.

Shoulder of Road and Sidewalks

Although road shoulders and sidewalks separate people from cars, this does not mean that pedestrians are completely safe while walking on sidewalks or the shoulders of roadways.

- Twenty-five (24 percent) pedestrians died while they were merely walking or standing near the road.

- In 13 of these deaths (52 percent), there was no sidewalk on the roadway.
- Nine pedestrians were struck while standing or walking on a sidewalk. Most of these incidents took place on a city street.

Motor vehicles struck and killed pedestrians who were walking or standing on sidewalks or shoulders of the road for a variety of reasons. These included:

- Large commercial vehicles backing up
- Out-of-control vehicles due to the drivers' sudden medical condition or mechanical failure
- Prior multiple vehicle crashes that resulted in vehicles traveling onto sidewalks
- Unattended vehicles traveling by themselves
- Motorist driving under the influence of alcohol or drugs.

Running

- In five deaths (five percent), pedestrians were running.
- In two of the cases, the pedestrian was running for a King County Metro bus. One was run over by the bus; the other was hit by an oncoming vehicle.
- In three of the cases, the pedestrians were running away from another person. One was running away from a family member, while the other two were running away from the police.

Miscellaneous Activities

The activities were difficult to categorize in nine cases. These activities included the following:

- Work site and construction-related incidents
- Pedestrian attempted to high-jack a car
- Pedestrian was passed out on the roadway
- Pedestrian was roaming and stopping vehicles on the street.
- Pedestrian attempted to board a bus while the bus was pulling away from the stop.

**Pedestrian Fatalities by Pedestrian's Primary Activity
King County 2000-2003**

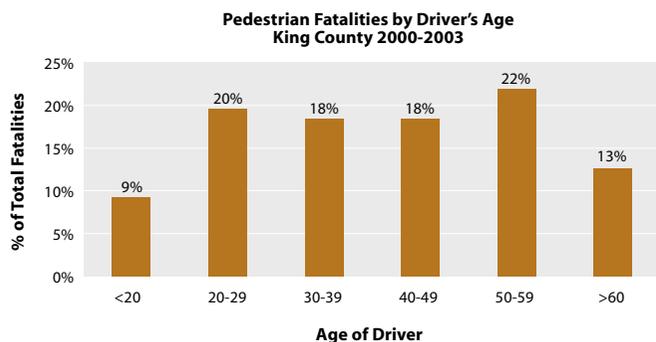
Pedestrian Primary Activity	No.	%
Crossing	64	62.1%
Crosswalk	17	16.50%
Against the light	7	6.8%
Unmarked crosswalk	4	3.9%
No-crossing zone	2	1.9%
Mid-block	21	20.4%
Interstate/state route	13	12.6%
Standing/Walking	25	24.3%
Roadway/shoulder	13	12.6%
Sidewalk	9	8.7%
Driveway	1	1.07%
Attending to vehicle on the roadway	2	2.0%
Running	5	4.9%
Running for a bus	2	1.9%
Running away	3	2.9%
Other	9	8.7%
Work/construction zone	5	4.9%
Miscellaneous activities	4	3.9%
Total	103	100.0%

Driver Characteristics and Contributing Factors

Age and Gender

There were a total of 101 drivers involved in the study, which resulted in the deaths of 103 pedestrians.

- Among drivers (when gender and age was known) males drivers were involved in nearly 70 percent of the incidents.
- The age distribution of drivers was relatively even. However, there were fewer younger and older drivers involved in these fatalities.
- Driver age ranged from 16 to 92 years, with an average age of 42.5 years.



Speed at Impact

Vehicle speed plays an important role in determining whether the vehicle will stop and yield for the pedestrian on a roadway and the likelihood of the pedestrian dying once struck by the vehicle.

Research shows that the majority of drivers do not stop when their speed exceeds 20 mph.¹⁶ Studies have also found that 95 percent of pedestrians will survive an impact at 20 mph but only 15 percent survive an impact at 40 mph.¹⁷

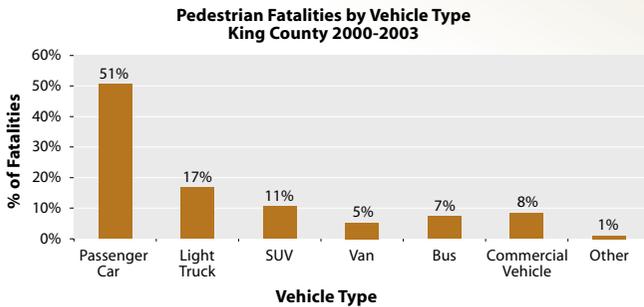
**Posted Speed on the Roadways for Pedestrian Fatalities
King County 2000-2003**

Posted Speed (mph)	No.	%
25	10	10.4%
30	23	24.0%
35	24	25.00%
40	10	10.4%
45	5	5.2%
50	2	2.1%
55	2	2.1%
60	20	21.0%
Total	96	
Unknown	(5)	(5.0%)

Furthermore, drivers of slower moving vehicles are more likely to observe their surroundings and are more likely to see and stop for pedestrians. However, when traveling at higher speeds, a driver is less likely to see and be able to stop if an unexpected pedestrian darts into the roadway.

Nationally, most pedestrian fatalities involving single vehicle crashes happened on roads with a posted speed limit between 30-39 mph (32 percent).⁹

- In this study, most pedestrian fatalities happened on roads with relatively low, posted speeds.
- Nearly 60 percent of the pedestrians were killed on roads with posted speed limits of 35 mph or less.



Vehicle Type

In cases where vehicle type was known:

- Passenger cars were involved in 51 percent of the fatalities.
- Light trucks and SUVs accounted for 28 percent of incidents.
- Seven incidents involved a bus—six were King County Metro buses; one was a tour bus.
- Eight collisions involved commercial vehicles (dump trucks and construction related vehicles).

Vehicle Activity at Impact

- In nearly 80 percent of the cases vehicles were going straight on the roadway.
- In 12 percent of the cases, the vehicle was making a left or right turn.

Driver Medical Conditions

- Three pedestrians died from crashes involving drivers with medical conditions.
- In two cases, the drivers were under the influence of medication, which

**Vehicle Activity at the Time of Incident
King County 2000-2003**

Vehicle Activity	Count	%
Straight	80	79.2%
Right turn	4	4.0%
Left turn	8	8.0%
Other	4	4.0%
Backing	5	5.0%
Total	101	

made them drive erratically, when they struck a pedestrian.

- In one case, the driver experienced a heart attack while driving.

Alcohol Involvement of Driver

Nationally, in 2001, 18 percent of the drivers who hit and killed pedestrians had used alcohol. Drivers 30 - 39 years old had the highest level of alcohol involvement and 79 percent of the drivers were male.⁹

Alcohol Use by King County Drivers Involved in Pedestrian Fatality Crashes by Sex and Age Group

Age Groups	Females	Males	Total
<20	0	0	0
20-29	0	6	6
30-39	3	1	4
40-49	0	1	1
50-59	0	2	2
60+	0	0	0
Total	3	10	13

- In this study, thirteen drivers were noted as under the influence of alcohol.
- Most of these drivers were male (10 out of 13).
- Six of the alcohol-positive drivers were between the ages of 20 to 29 years. All were males.

Hit and Run

- In this study, 10 pedestrians were killed in hit and run incidents (driver failed to stop the vehicle and fled the collision scene).
- Police eventually identified two drivers involved in hit and run cases.
- Compared to the national average (2001), King County had fewer hit and run pedestrian fatalities (18 percent vs. 10 percent).

Driver-related Contributing Factors and Traffic Citations

Nationally, NHTSA states that most police accident reports do not mention driver-related factors contributing to the pedestrian-motor vehicle fatalities.⁹

- In this study, police reports indicated that in 45 percent of the cases (where contributing factors were noted), investigators found no fault with the driver's actions.
- In the cases where drivers were at fault, "inattention" was the leading factor (19 cases).
- "Failure to yield" to a pedestrian was noted in 14 cases.
- Speeding was mentioned only four cases.

Among the 84 drivers whose citation status is known:

- Over 60 percent of drivers had no charges filed against them.
- "Negligent Driving in the 2nd degree" was the most common citation (nearly 18 percent).
- Four drivers were charged with vehicular homicide.

Citations Received by Drivers
King County 2000-2003

Citations Received	No.	%
No charges	52	51.5%
Vehicular homicide	4	4.0%
DUI underage	1	1.0%
DUI	1	1.0%
Negligent 2nd Deg	15	14.9%
Unattended motor vehicle	1	1.0%
Emerging from alley, driveway, private property	1	1.0%
DWLS 3rd deg-driving without a license revoked/suspended	1	1.0%
Failure to yield to pedestrian in crosswalk	3	3.0%
Speeding	1	1.0%
Following too closely	1	1.0%
Driving without insurance	1	1.0%
Hit-and-run + DUI	1	1.0%
DUI + reckless	1	1.0%
Unknown	17	16.8%
Total	103	100.0%

Total Driver-Related Contributing Factors
King County 2000-2003

Contributing Factors	No.	%
DUI-alcohol and drugs	13	9.3%
Speeding	7	5.0%
Lane errors	4	2.9%
Improper passing	2	1.4%
Inattention	19	13.6%
Failure to yield	14	10.0%
Failure to obey	1	0.7%
Drowsiness	6	4.3%
Following too closely	1	0.7%
Improper backing	1	0.7%
Other	30	21.4%
No errors cited	42	30.0%
Total	140	100.0%
Missing	(7)	

*This total exceeds the number of incidents because police report may record more than one contributing factor.

Recommendations

1. Convene a King County pedestrian traffic safety conference.

- Seattle and King County have a number of professionals, from various disciplines, with expertise in pedestrian and traffic safety. Bringing these experts together, with other stakeholders, is a first step in addressing the issue of pedestrian deaths and injuries in a holistic, collaborative manner.
- Include staff from the Washington Traffic Safety Commission, Feet First, and Active Living by Design in conference planning and implementation.

2. Reconvene a King County pedestrian safety advisory group to provide a forum in which issues can be brought forth and problems can be addressed.

- Reconvene a group similar to the Puget Sound Pedestrian Safety Coalition which was disbanded several years ago.
- This would provide a venue for communities to share best practices (e.g. strategies implemented in Kirkland and Bellevue) with other King County cities.
- This group could also gather data on pedestrian injuries, look at best practices from other states and within Washington to make recommendations regarding education, enforcement, and engineering changes.

3. Extend this study to include non-fatal pedestrian injuries within King County.

- This will ascertain the magnitude of the problem, identify pedestrian accident locations, and better describe risk factors associated with pedestrian injuries for both fatal and non-fatal injuries.
- Various databases, such as police records, the trauma registry and hospital records could be used to collect injury data. For example, all cases involving pedestrian-motor vehicle crashes reported to the police could be sent to one central agency. This agency could maintain a surveillance database that is used to inform policies and educational activities to reduce pedestrian injuries.

4. Conduct a knowledge, attitude, and behavior survey (KABS) of King County residents to learn about the public's perceptions and behaviors related to pedestrian safety.

- Use the KABS to develop and conduct educational interventions with the general population.

5. Design and implement educational efforts with the identified intervention groups.

- Conduct focus groups and KABS with intervention groups such as Asian Americans, Native Americans, males 40 - 49 years old, homeless & day laborers, women over age 60, children, and drivers involved in pedestrian crashes to gather qualitative data to design appropriate educational strategies to reduce pedestrian injuries.

6. Increase pedestrian safety enforcement activities.

- Ticket both pedestrians and drivers.
- Work with officers participating in DUI patrols to solve issues related to impaired pedestrians.
- With the support of the mayor, Salt Lake City increased their efforts to reduce pedestrian injuries. The city increased fines to drivers who fail to yield to disabled pedestrians, pedestrians carrying orange flags, and school crossing guards. Drivers must also appear before the court. The city also increased fines for first offense driver violations.¹⁸
- In South Australia, the government passed the Public Intoxication Act. This law gives police the right to detain intoxicated pedestrians, without arrest, for safety purposes.¹⁹
- Washington State has a similar law. Stated in RCW 46.61.266 states the following:²⁰

A law enforcement officer may offer to transport a pedestrian who appears to be under the influence of alcohol or any drug and who is walking or moving along or within the right of way of a public roadway, unless the pedestrian is to be taken into protective custody under RCW 70.96A.120

Implementation of this practice may decrease fatality and injury among intoxicated pedestrians.

7. Design and implement a pedestrian visibility campaign that targets both drivers and pedestrians.

- Encourage pedestrians on the use of reflective clothing in low light settings and encourage pedestrians to walk in streets and roads with adequate lighting.
- Encourage drivers to increase visual scanning of the roadway particularly at night.
- Inform pedestrians about driver difficulty in seeing them in dark and adverse weather conditions.
- Inform pedestrians about dangers of crossing even in marked crosswalks.

8. Work with city, county, and state departments of transportation to ensure that high-risk locations are properly illuminated with street lights and that broken lamps are promptly repaired.

9. Educate pedestrians about the risks of alcohol and walking.

- The public is aware of the dangers of drinking and driving, but may be uninformed about risks intoxicated people experience while walking on or crossing roadways.

10. Advise and educate drivers on the safest ways to deal with mechanical failure in the roadway, especially on freeways and highways.

- There were several cases where individuals attempted to cross multi-lane interstates to get help after their vehicle had a mechanical failure.

¹ Kwan I, Mapstone J, Roberts I. "Interventions for increasing pedestrian and cyclist visibility for the prevention of death and injuries." Cochrane Database Syst Rev. 2002;(2):CD003438.

References

1. U.S. Department of Transportation: National Highway Traffic Safety Administration. Traffic Safety Facts 2003: Pedestrian. Available at: <http://www-nrd.nhtsa.dot.gov/departments/nrd-30/ncsa/AvailInf.html>
2. Washington State Department of Health: Injury & Violence Prevention Program. Available at: http://www.doh.wa.gov/cfh/Injury/data_tables/table_directory.htm.
3. Washington State Department of Health, Center for Health Statistics. Using VISTA.
4. U.S. Census Bureau: American Fact Finder- King County, WA. Available at: http://factfinder.census.gov/home/saff/main.html?_lang=en.
5. Bailey L. Aging Americans: Stranded without options. Surface Transportation Policy Project; April 2004. Available at: <http://www.transact.org/report.asp?id=232>
6. Koepsell T, McCloskey L, Wolf M, et al. Crosswalk markings and the risk of pedestrian-motor vehicle collisions in older pedestrians. *JAMA*. 2002;288(17):2136-2143.
7. Schieber RA, Vegega ME (Editors). National Strategies for Advancing Child Pedestrian Safety. Atlanta, GA: Centers for Disease Control and Prevention, National Center for Injury Prevention and Control, 2001. Available at: <http://www.cdc.gov/ncipc/pedestrian/>
8. Retting R, Ferguson S, McCartt A. A review of evidence-based traffic engineering measures designed to reduce pedestrian-motor vehicle crashes. *American Journal of Public Health*. 2003;93(9):1456-1463.
9. U.S. Department of Transportation: National Highway Traffic Safety Administration. Pedestrian Roadway Fatalities, April 2003. Available at: <http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/Rpts/2003/809-456.pdf>
10. Washington State Traffic Safety Commissioner, National Highway Traffic Safety Administration-Fatality Analysis Reporting System. Pedestrians Killed in Washington State, 1993-2003.
11. King County Medical Examiner's Office. King County Medical Examiner's Office 2003 Annual Report. Manner: Traffic. Available at: <http://www.metrokc.gov/health/examiner/2003report/Index.htm>
12. Leibowitz H, Owens D, Tyrrell R. The Assured Clear Distance Ahead Rule: Implications for Nighttime Traffic Safety and the Law. *Accid Anal and Prev*. 1998;30(1):93-99.
13. Tyrrell R, Wood J, Carberry T. On-road measures of pedestrians' estimates of their own nighttime conspicuity. *Journal of Safety Research*. 2004;35:483-490.
14. Luoma J, Penttinen, M. Effects of experience with retroreflectors on recognition of nighttime pedestrians: comparison of driver performance in Finland and Michigan. *Transportation Research*. 1998; F(1): 47-58.
15. Kwan I, Mapstone J. Visibility aids for pedestrians and cyclists: a systematic review of randomised controlled trials. *Accid Anal and Prev*. 2004;36:305-312.
16. Garder P. Pedestrian Safety in Maine: University of Maine-Dept. of Civil & Environmental Engineering; May 2002.
17. World Health Organization. World report on road traffic injury prevention, 2004. Available at: http://www.who.int/world-health-day/2004/infomaterials/world_report/en/.
18. Salt Lake City Division of Transportation. Pedestrian safety. Available at: <http://www.slcgov.com/transportation/PedestrianTraffic/>
19. Holubowycz O. Age, sex, and blood alcohol concentration of killed and injured pedestrians. *Accid Anal and Prev*. 1995;27(3):417-422.
20. Section 46 Revised Code of Washington: Wash Rev Code §46.61.266. Available at: [http://www.leg.wa.gov/rcw/index.cfm?fuseaction=title&title=U.S. Department of Transportation: National Highway Traffic Safety Administration. Traffic Safety Facts 2003: Pedestrian. Available at: <http://www-nrd.nhtsa.dot.gov/departments/nrd-30/ncsa/AvailInf.html>](http://www.leg.wa.gov/rcw/index.cfm?fuseaction=title&title=U.S. Department of Transportation: National Highway Traffic Safety Administration. Traffic Safety Facts 2003: Pedestrian. Available at: http://www-nrd.nhtsa.dot.gov/departments/nrd-30/ncsa/AvailInf.html)